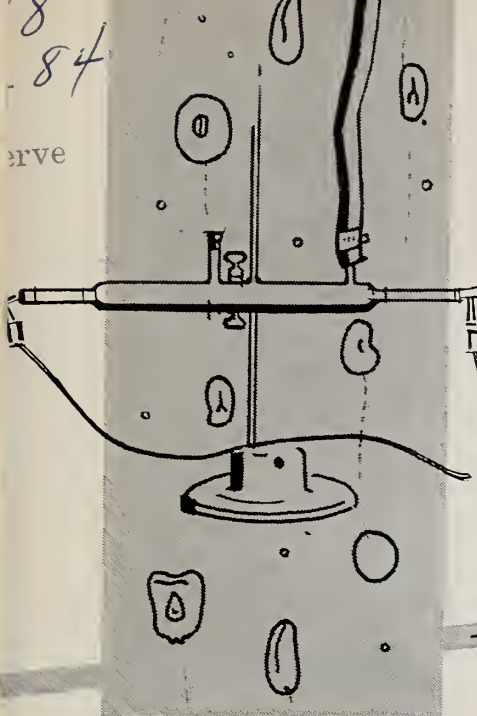


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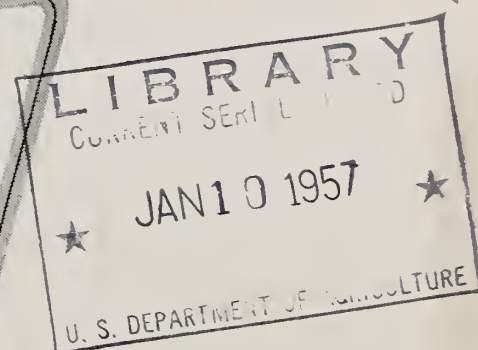


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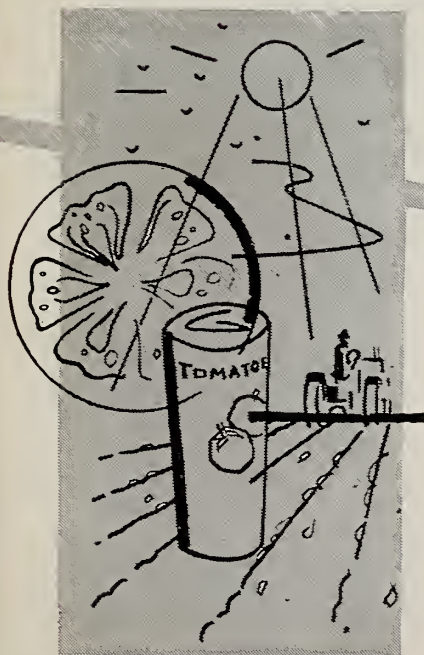
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AGRICULTURAL Research



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UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

Vol. 5—January 1957—No. 7

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More for less

Research shows that farmers should get a dozen eggs with 5 pounds of feed. They're actually using almost 7 pounds.

That's poor feed efficiency—a matter of concern today for every livestock, dairy, and poultry producer.

We've made big advances in *efficiency per head*. We've used incubators to hatch more chicks per layer, learned how to save more pigs per litter, bred cows that give more milk.

But we haven't gone far on *efficiency of feed conversion*. Farmers haven't cut down enough on the amount of feed they pour in to get a pound of meat or milk or a dozen eggs.

That's a good way to cut the cost of livestock production because feed accounts for a big share of the bill.

The fact is that we know enough to do better. Broiler and turkey raisers have done the best job of putting research into practice. Farmers have made some progress with hogs and beef cattle, a little in milk production, none on eggs.

So the first thing we need to do—research, extension, industry working together—is to help get research results into wider use. We need to help farmers close the gap between what they're doing and what they *can* do.

And the next job is to break through the research ceiling on feed efficiency. We can do this in three ways:

1. Breeding. No farmer can rise above the genetic capacity of his stock. Steers from lines selected for efficient meat production gain 2½ pounds a day on the same feed that puts on only 2 pounds in standard commercial strains.

2. Feeding. We need to know much more about the nutritional requirements of animals, toxic substances in feeds, interrelationships of various elements in feed, the role minerals play in growth and feed utilization, and so on.

3. Management. Anything that affects an animal affects its efficiency—not only breeding and feeding but also such influences as heat and humidity, internal parasites, insects and diseases. We must find out what to do and how to do it.

We're beginning to break through some of these research ceilings. We should be able to develop information on feed efficiency that will give livestock producers better returns.

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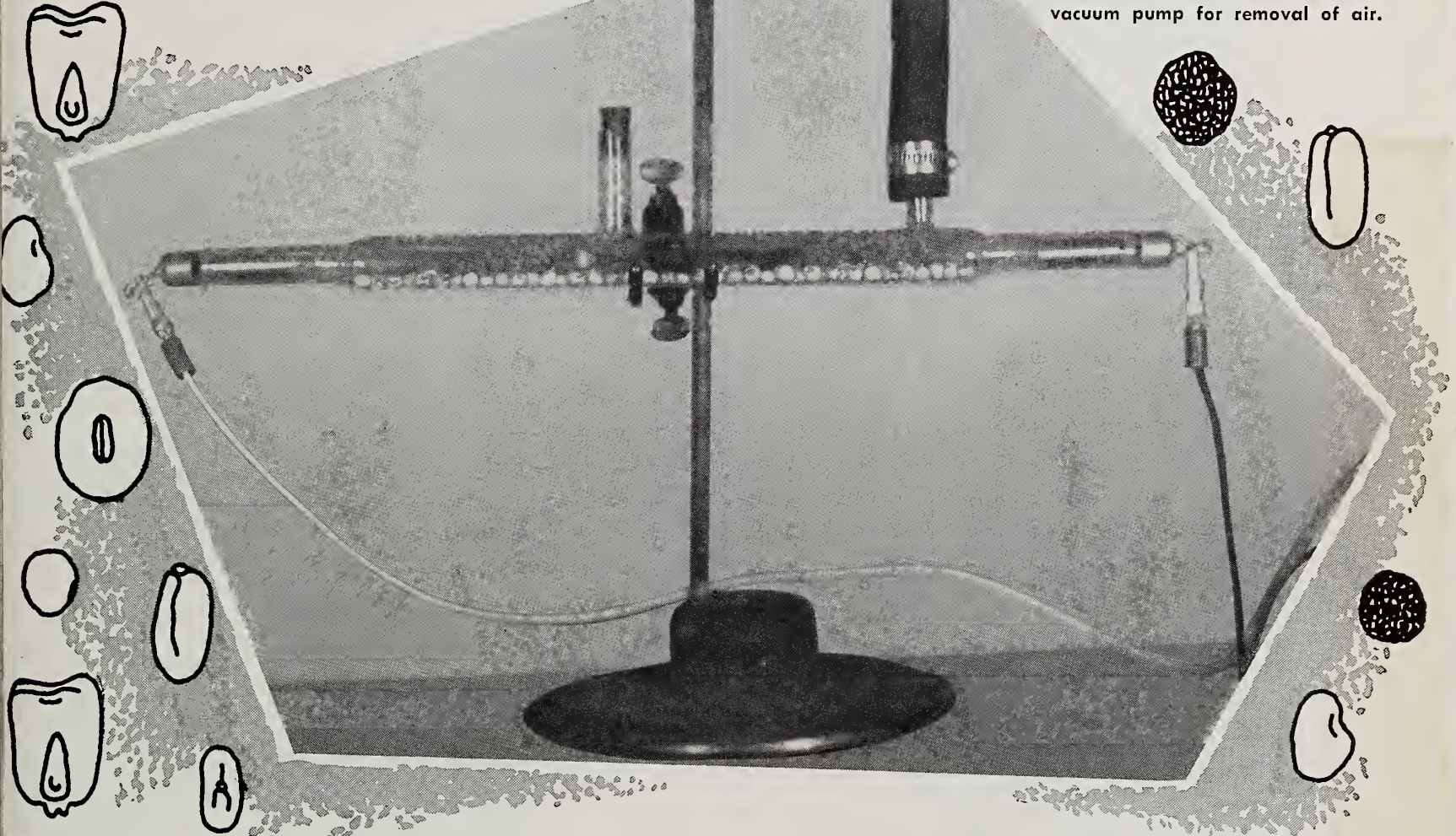
AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Possibilities in SHOCK TREATMENT

Low-frequency electrical energy may help do such jobs as improve germination, dry grain, process food, and kill weed seeds



TREATING TUBE has terminals at each end; current passes along length of tube. Corked mouth admits seeds. Hose is connected to a vacuum pump for removal of air.



■ OPENING UP new basic and applied research possibilities in shock treatment of seed is an electrical device invented by USDA agricultural engineer O. A. Brown and associates.

The device is being used to study effects of low-frequency electrical energy for treating seeds, in cooperative ARS-State work at the Tennessee experiment station, Knoxville.

Bringing new methods of seed treatment into play, and capable of greater control than was possible with other methods, the device has been submitted for public patent.

Experimentally, a working model gave uniform results in repeated treatments of corn: germination was speeded up or retarded at will and rate of water sorption was increased.

Of comparable importance are the selective possibilities of the device. Its simple, low-cost design and operation may facilitate the treatment of seed for specific purposes such as drying, easier processing, or even destroying weed-seed embryos.

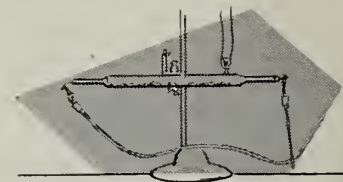
Results in experimental treatment of soybeans point up possibilities of the device for preprocessing de-

hydrated seeds for food. Irradiation by the machine materially increased the rate of water sorption in soybeans. A few minutes after the beans were placed in water, they swelled to twice the size of control seeds; in 30 minutes, the irradiated seeds disintegrated. Soybeans, incidentally, are among the most difficult seeds to prepare for human consumption.

Corn germination promoted

The experiments have shown that corn seeds exposed to electrical radiation for a short time germinate some-

CORN GERMINATED faster and more uniformly after exposure at less than atmospheric pressure to low-frequency electrical radiation at the low intensity shown below.



Untreated Control



Treated at 4 milliamperes



Treated at 8 milliamperes



Treated at 16 milliamperes



what faster and more uniformly than unexposed seed. But field trials covering 2 years have not shown that yields are significantly higher.

Shock inhibits some seeds

Whether the combined method and machine will be effective in destroying embryos of unwanted seeds has not been fully determined. In field tests, however, germination of purple-top turnip seeds was fully inhibited whereas red clover and smooth mustard were apparently unharmed.

The idea of irradiation with electrical energy to induce changes in seed goes back fully 200 years—not long after Benjamin Franklin found through his famous kite experiment that lightning was electricity.

The simplest way to apply electric energy to a living organism is to make it part of the electric circuit. But results can't be predicted because of the variables in the materials being treated, even as between seeds of the same kind. Placing seeds in an electric field of radio frequency is another method in wide use by experimenters. This type of treatment offers the advantage of a strong electric field, but the magnetic field is weak.

Still another method that's frequently used is placing seeds in an electric field and increasing the current or potential until an arc forms between the electrodes (positive and negative terminals). The seeds are thus treated by both high electric and magnetic fields, but not simultaneously. The result is probably similar to the treatment field seeds get when lightning strikes a field.

Control difficult formerly

Generally, in seed-treating experiments, researchers have used high-frequency electric current. (Alter-

nating household current, at 60 cycles a second, is low-frequency. A current of between 3 and 30 megacycles a second—a megacycle equals a million cycles—is high-frequency.) Brown points out that the major disadvantage of high-frequency energy, however applied, is inability to control its effects on seeds. Because of the difficulty of control, past electric treatments have been neither uniform nor necessarily the specific treatments required for specific seeds.

The working model of Brown's seed-treating device is simplicity itself. It consists of a glass tube, horizontally mounted, and fitted with electric terminals or electrodes at each end. The tube has two mouths on top. One, corked in operation, admits the seeds for treatment. The other opening is fitted with a hose connected to a vacuum pump for the removal of all or a part of the air in the tube. Passage of current along the length of the tube from electrode to electrode is regulated by a normal, variable, high-voltage source of power. Obviously, the electric energy and the air pressure in the tube can be changed and controlled by the operator.

Departures in new method

In Brown's tests, the seeds were subjected to radiation from the glow discharge of the low-frequency electric current, at less than atmospheric pressure (15 pounds per square inch). Conducting the tests at less than atmospheric pressure and with low-frequency current are major departures from the usual methods used.

Being adaptable to current of either high or low frequency, the method and the device provide means of broad study of the effects of radiation on seed and the application of treatments for specific purposes.☆

A way to improve TAX APPRAISALS

Basing land valuation on earning power of soil is systematic, flexible approach to a complex matter



■ TAX ASSESSORS find assessing the value of a home or other personal property relatively simple compared to evaluating agricultural land.

USDA agricultural economist W. F. Hughes suggests a systematic and flexible approach providing a high degree of uniformity in rural land appraisal. The method proposed by the ARS researcher, working in co-operation with the Texas experiment station, calls for appraisal according to earning power of the soil.

To arrive at net return per acre, soils in a given area are classified by type. Local landowners are queried

for information, and reference is made to soil surveys for data.

Crop yields, production requirements, use of cropland, and cost of materials are determined. The yield figures reflect soil variations. The production requirements reflect quantities of seed, fertilizer, and insecticide needed to produce crops. Use of the land includes a breakdown of net returns from predominant crops. The prices paid for various materials, services, and equipment are obtained, sometimes from marketing reports, to determine net returns. Pasture values are estimated by a similar method,

taking into account the number of grazing days per acre.

Net return per acre is converted to an economic index with all soils rated percentagewise against the land yielding the highest return. Those ratings are transferred to a soil map to show the relative earning capacity of all land that is classified in the area.

The map provides a basis for equitable valuation. Subsequent price changes in costs and income affect land value, but not necessarily economic ratings. Once relative values are known, appraisers appropriate value to various classes of land.☆

ECONOMIC RATING OF SOIL BASED ON NET RETURNS

Segment of Kaufman County, Texas, which has 28 soil classifications

\$28.67
average net return per acre.
Bell clay net returns are the highest
of 28 soil classifications in the county,
so this soil rates 100%.

BELL CLAY

\$11.64
average net return per acre.
Irving Clay rates eighth among the
28 soil classifications, or 40%.

IRVING CLAY

Cotton - 70% of area
Yield - 240 lbs. an acre
Net Return - \$38.47

Corn - 20% of area
Yield - 30 bu. an acre
Net Return - \$21.01

Sorghum - 5% of area
Yield - 28 bu. an acre
Net Return - \$14.67

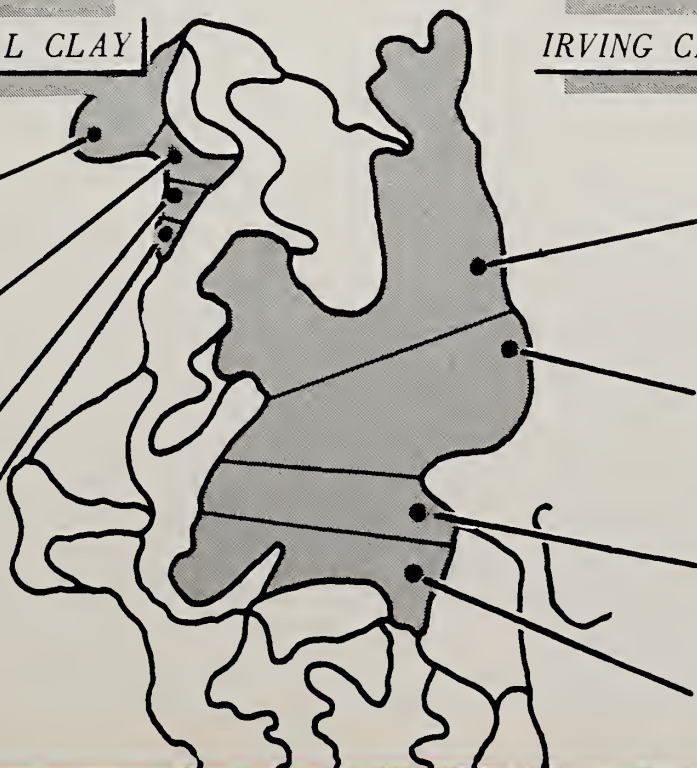
Unclassified - 5% of area

Cotton - 50% of area
Yield - 180 lbs. an acre
Net Return - \$22.15

Corn - 20% of area
Yield - 20 bu. an acre
Net Return - \$6.91

Sorghum - 5% of area
Yield - 24 bu. an acre
Net Return - \$9.59

Unclassified - 25% of area.



Remaking SERICEA LESPEDeza

Breeding and management
can help overcome its low
palatability, lack of vigor



SOFTNESS OF STEM makes this plant more palatable. To breed pasture sericeas, it's necessary to use this soft-stemmed character but none of the plant's faulty traits—high tannin and low yield.



EARLY FLOWERING, this lespedeza's principal asset, is largely heritable. Plant breeders hope to put it into a better new sericea for the future. This plant has high tannin and inadequate foliage.

LOW TANNIN—3 percent—makes this a particularly valuable line. This character is about 40 percent heritable, so the plasm gives geneticists latitude in producing good nonbitter lespedeza.



■ **RECENT RESEARCH** gives scientists a systematic basis for possibly remaking sericea lespedeza into a much better forage crop. But the job may be long and tedious owing to sericea's genetic complexity.

This important perennial legume has many assets. But it also has two serious shortcomings. Sericea is unpalatable to livestock—has too much bitter tannin and is coarse. And it is nonvigorous in the seedling stage, making it difficult to establish in a planting.

In preliminary research, USDA and the Alabama and North Carolina experiment stations have done breeding work with varied lines of sericea. Some developed naturally and the others were produced by X-raying the seeds. All are above average in at least one character.

Low-tannin types are among the most promising but as yet are agronomically inferior. About 40 percent of their tannin variation is due to inheritance, controlled by some 20 to 25 pairs of genes. So it should be possible to combine low tannin with other good qualities.

Inbreeding in seed fields may be partly responsible for the poor start of sericea plantings. Small cleistogamous (nonopening) flowers predominant in some seed fields are self-pollinated and bear small seeds. Plants from those seeds lack vigor because of both inbreeding and small seed size. Showy chasmogamous (open) flowers plentiful in other fields are largely cross-pollinated. Seeds from chasmogamous flowers are larger and often have hybrid vigor when crossed. In tests by ARS and the North Carolina station, progeny of chasmogamous flowers yielded 11 percent more forage than those of unopened flowers.

Sericea fields have a mixture of chasmogamous and cleistogamous flowers. Relative amounts of each vary widely from field to field. Where sericea isn't grazed or mowed, most flowers form during warm days of late summer and are largely the showy, open type destined for crossing. But grazing or mowing sets flowering back into fall and the cool, short days cause a predominance of closed flowers, self-pollination, and weak progeny. So, in the view of ARS agronomist P. R. Henson, seed growers understanding environmental effect can control seed size and crossing to some extent by the way they manage the crop. But much of the variation is regulated by genes—many of them—and that enables plant breeders to do something about seedling establishment.

Other characters may be partly mastered by breeders. One is variation in plant height, 55 to 60 percent of which is apparently controlled by 13 to 34 pairs of genes. Another is date of maturing, 90 percent dependent on inheritance through 10 to 22 pairs of genes. About 4 pairs have 75 to 90 percent control over seed size. ☆

THEY LIKE POTATO FLAKES

Market tests of this new dehydrated product showed consumers were satisfied—they wanted to buy more



■ **POTATO FLAKES**—a new form of dehydrated mashed potatoes—were recently shown by USDA marketing tests to be popular with consumers and to have high potential.

Most striking effect of these tests was the high rate of potato-flake sales achieved initially and maintained during the market test period.

Developed by the ARS Eastern Utilization Research Branch, Philadelphia, Pa., this product is made from potatoes that have been peeled, cooked, mashed, and dried in continuous thin sheets. Mixing the flakes with hot milk and/or water, salting to taste, and whipping lightly makes creamy, fluffy, mashed potatoes (AGR. RES., February 1955, p. 12).

Declining per capita consumption of potatoes, despite a growing trend toward more potato processing, poses a serious problem to growers. The flakes were developed as a convenience product for household use to help expand the market for potatoes.

Tests include three cities

The market tests were held in the Triple City area of Binghamton, Endicott, and Johnson City, N. Y. This area, with a population of about 150,000, was selected as fairly typical of medium-sized metropolitan areas in the region. Tests were conducted by the Agricultural Marketing Service in cooperation with ARS, the Maine Department of Agriculture, Maine Agricultural Experiment Station, and Maine Potato Commission.

Potato flakes were offered for sale in 41 supermarkets that account for about 85 percent of retail food sales in the test area. Virtually the entire available supply—894 cases, each containing 24 four-serving boxes—was sold during the 5-week test period. This represented purchases by about 14 percent of the households in the Triple City metropolitan area.

Flakes have strong appeal

Records were obtained from the stores on sales of potato flakes and 14 other competing products. Comparisons based on audited sales data showed that only 2 products outsold the flakes—fresh potatoes by 15 to 1, and potato chips by 2 to 1. Except for these two products, sales of potato flakes, on a fresh-equivalent basis, were greater than all other processed potato products. Potato flakes even surpassed frozen French-fried potatoes, normally one of the biggest sellers among all frozen vegetables.

Consumers were interviewed after the test period to learn their reactions to the new product. Marketing researchers found that 6 of each 10 initial buyers made 2 or more purchases of the test product, and 9 of each 10 said that they would buy the product again if it was available. Eighty-eight percent of the users were generally satisfied with the product, 87 percent were satisfied with its taste, and 83 percent were satisfied with its texture. Researchers say the relatively short period of the product's

OD & HOME · FOOD & HOME · FOOD &

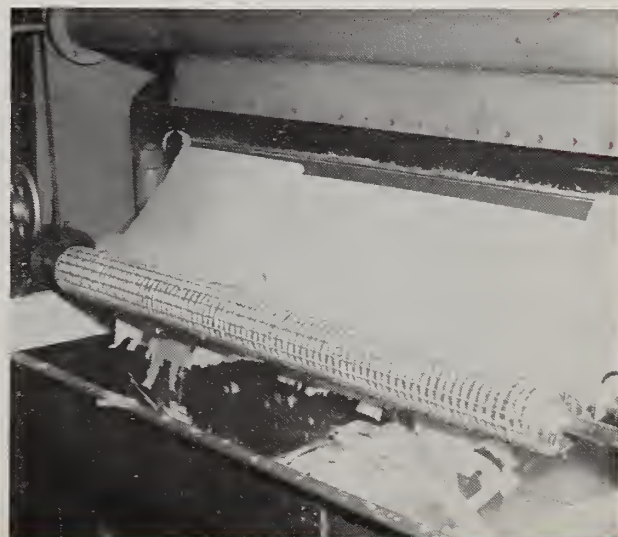
availability in stores made the high degree of consumer acceptance, particularly the large number of repeat purchases, all the more impressive.

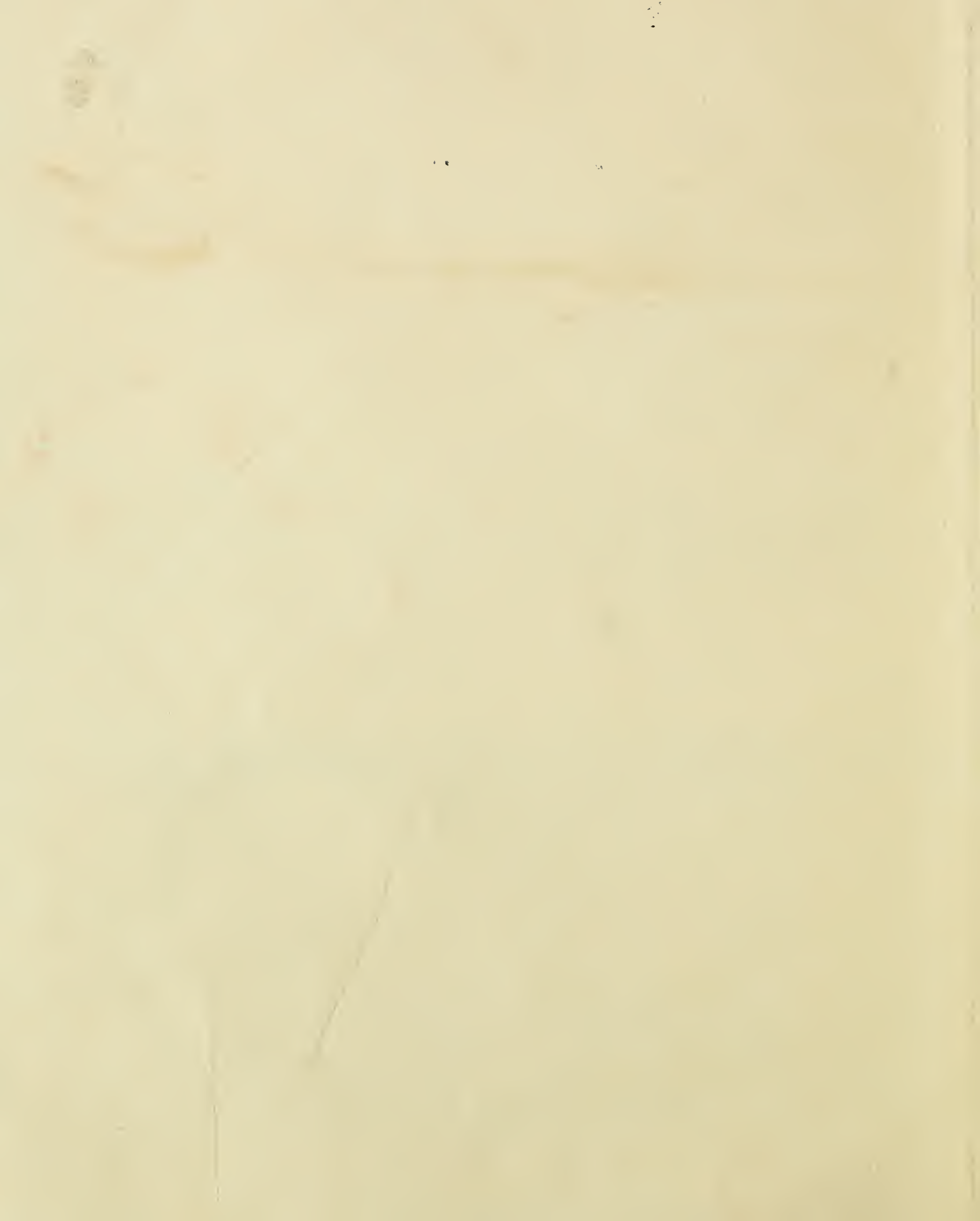
Several limiting factors must be considered in making these comparisons. One was the short test period of only 5 weeks. Another was the promotional campaign for the first 4 weeks. Still another was the unusually high cost of fresh potatoes. Finally, the flakes were placed on sale in the summer, when there is a tendency to use quickly-prepared foods. All this probably contributed to sales of flakes. More detailed analysis of data will be made in a later report.

Demonstrations push sales

In-store demonstrations were a powerful sales stimulus. For the 5-week test period, demonstrations accounted for an estimated 25 percent of total potato-flake sales.★

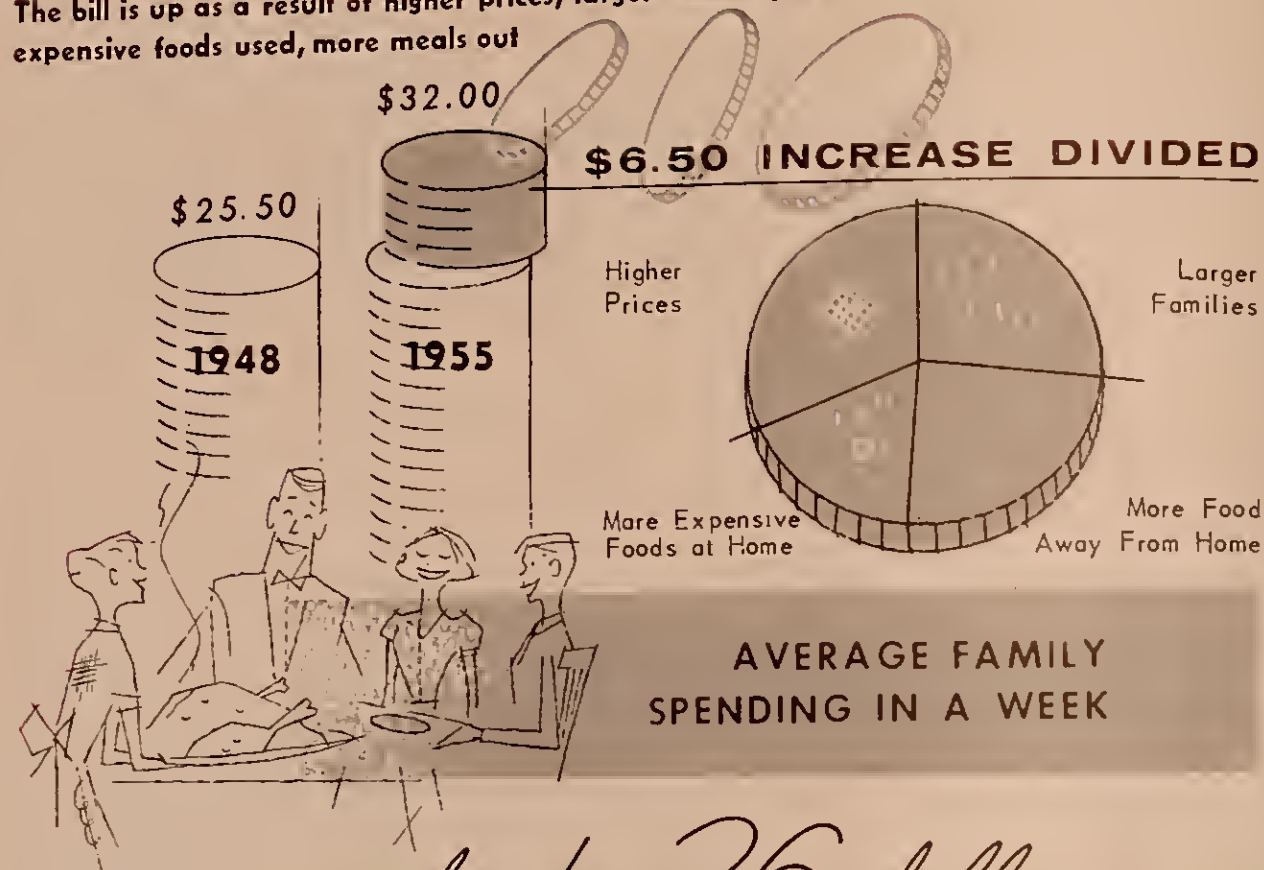
WIRE MESH scores sheet of dried mashed potatoes (coming off a drum drier) to enable easier flaking and screening—last stages in processing. Potatoes are first peeled, then sliced, precooked, steam-cooked, riced, and mixed. This mash is fed to the drum drier.





What city families spend for food

The bill is up as a result of higher prices, larger families, more expensive foods used, more meals out



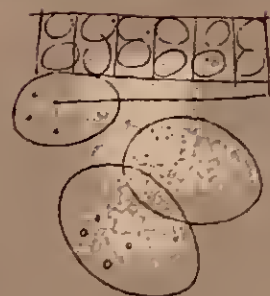
of the 26 dollars spent weekly for food eaten at home...

HALF WAS SPENT FOR...



Meats, poultry, fish

14.0 lb. **\$8.60**



Eggs

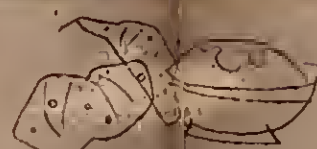
1.9 doz **\$1.00**



Milk and milk products

14.3 qts. **\$4.00**

ONE-FIFTH WAS SPENT FOR...



Potatoes and sweet potatoes

5.6 lb. **\$3.52**



Fresh fruits and vegetables

17.2 lb. **\$2.51**



Frozen fruits and vegetables

7 lb. **\$2.26**



Canned and dried fruits and vegetables

5.0 lb. **\$1.03**



Fruit and vegetable juices

4.0 lb. **\$5.42**

AND THE REST FOR...



Flour and other cereal products

4.2 lb. **\$1.00**



Bakery products

7.1 lb. **\$1.00**



Fats and Oils (including butter)

2.7 lb. **\$1.04**



Other foods

\$4.34

■ CITY FAMILIES report a high level of food spending—\$32 a week average—in a USDA survey. Of this, \$26 was paid for foods used at home, \$6 for restaurant meals and snacks.

The survey, made in the spring of 1955, covered 6,000 families of all sizes, in cities and rural areas and on farms, selected to give a picture of the country as a whole.

How high the level of food spending was can be seen by comparing it with the 1948 level, from a similar survey. That year, city families of 2 or more persons spent \$25.50 a week—\$6.50 less than in 1955.

What are some of the factors that account for increased food spending by city families in 1955? Although higher retail food prices are uppermost in people's minds, higher prices account for only a little over one-fourth of the \$6.50 increase.

Larger families with more persons to feed explain another fourth. In

1955, city families averaged 3.5 persons; in 1948, 3.3 persons.

Of great importance, too, in accounting for the increase are more expensive kinds of food chosen to serve at home. More meals and snacks purchased away from home—costing more than home-prepared food—also added to spending.

The survey was a joint effort of Agricultural Research Service and Agricultural Marketing Service. Among staff members who contributed are ARS statistician Janet Murray, food economists Faith Clark and Ennis Blake; AMS economists G. R. Rockwell, Jr., and T. J. Lanahan, Jr.

The first report from the survey gives data on the consumption of some 200 foods, separately and grouped as shown below. The tables make it possible to study the food consumption of households in different income groups and living in cities and rural areas and on farms. Additional re-

ports will give figures further broken down by region—Northeast, North Central, South, and West.

Half of the food budget of the average city family is spent for meats, poultry, fish, eggs, and milk products. The average amount of these foods purchased came to nearly 14 pounds a family for a week.

Fruits and vegetables are another important group in the household food budget, taking nearly one-fifth of the city family's food dollar, or almost \$5 a week. Despite the growing importance of processed products, fresh fruits and vegetables still take more of the city household's food dollar than do frozen and canned fruits and vegetables and juices.

Food consumption reports based on this survey are available from the USDA Office of Information. The series of reports will also deal with dietary levels, marketing information, and other survey data.☆

DOES AIRCRAFT NOISE AFFECT LIVESTOCK?

Researchers are looking for any reactions, anatomical changes, production influences



■ WHAT HAPPENS to livestock exposed to prolonged jet aircraft noise?

Preliminary USDA investigations may soon provide an answer to this puzzler. Farmers and livestockmen, concerned about possible effects of jet noise on farm animals, would like to know more specifically:

Does prolonged jet aircraft noise cause a drop in egg or milk production? Does meat production from meat-type animals go down? Does feed efficiency decrease? Do any actual physiological changes occur?

To determine the answers to these and similar questions, the U. S. Air Force recently contracted with ARS to begin a series of jet-noise experi-

ments on pigs. Pigs were selected because they grow rapidly and have shorter life-cycles than larger animals. Results of this long-range research are expected to provide noise tolerance levels for stock.

No outward effects noticed

Work so far shows that exposed animals display no outward symptoms and undergo no anatomical changes.

Jet noise experiments began early in January 1956, at the Agricultural Research Center, Beltsville, Md., with animal physiologist C. F. Winchester in charge, assisted by animal husbandman James Bond. The acoustical and electronic work is being car-

ried out by agricultural engineer L. E. Campbell assisted by J. G. Hartsock and J. C. Webb. Numerous other workers have made substantial contributions to the project.

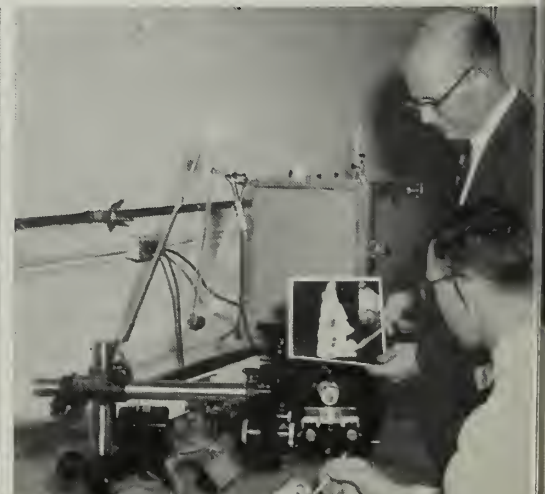
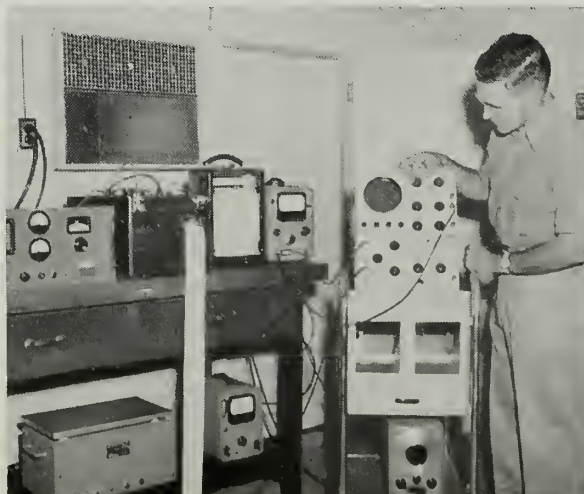
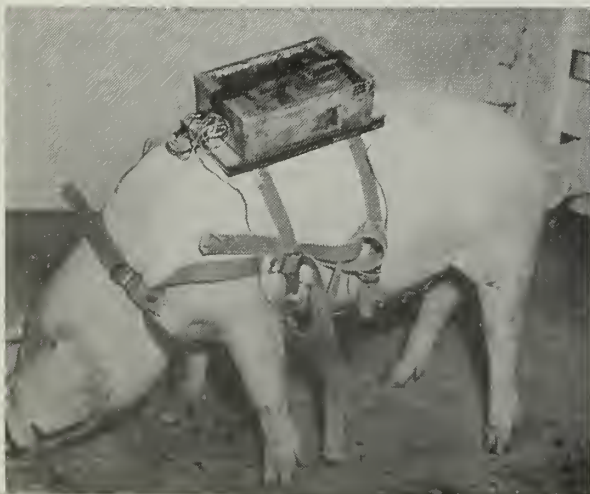
All current work is on meat-type hogs. This phase of the research will continue at least through June 1957. Future similar studies are planned soon with dairy cattle.

Under present testing procedure, 6 pigs in each of 3 pens are exposed at intervals during the day—6 a. m. to 6 p. m.—to the recorded sound of both the jet and the conventional piston-type aircraft “flyovers.” (One pen with 6 control animals is located outside the range of noise.) Sound

RADIO-electrocardiograph, a subminiature radio transmitter that's powered by hearing-aid-type batteries, checks the test animal's heart action before, during sound exposure.

CARDIOGRAPHIC signals are picked up by a radio receiver (left), displayed on an oscilloscope (right), and recorded as electrocardiograms on instruments shown in center.

TEST ANIMAL'S ears, thyroid and adrenal glands are carefully studied by University of Maryland zoologists for possible changes due to jet noise. So far, none have been found.



is piped into the test pens during the 12-hour period at pre-determined irregular intervals ranging from only a few seconds to 10 or 12 minutes. Sound intensity varies from 110 to 135 decibels. Maximum intensity of sound 1 mile from a jet airfield is about 120 decibels. (Sound intensity beside a large tractor normally ranges between 95 and 100 decibels.)

Period of exposure varied

Animals are also exposed to constant jet sounds for definite periods of time, and to pure tones (produced by a tuning fork) of different levels. Some of the pigs were born right into the jet-noise environment. Researchers hope to discover if life-long exposure to this sound may be a factor in determining tolerance.

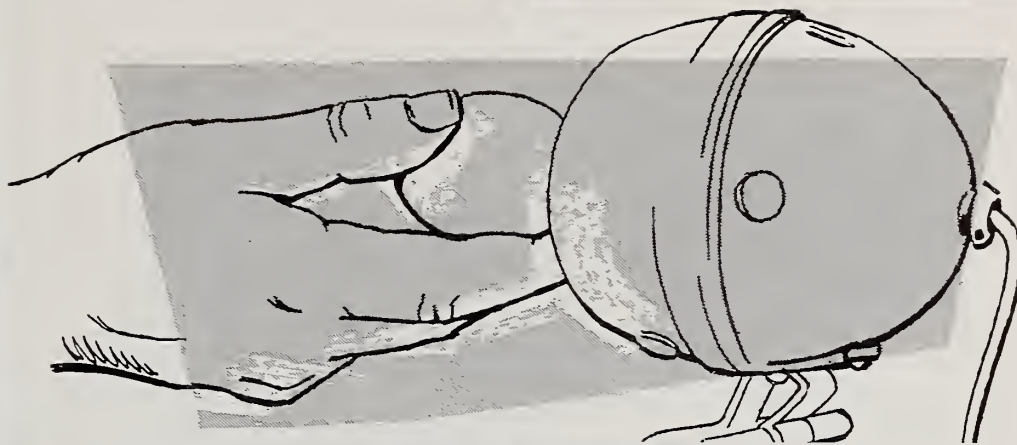
In another aspect of the experiments, researchers are using a radio-electrocardiograph to measure changes of heart rate in the animals.

Outwardly, the pigs do not appear to be affected by the noise. The only visible reactions are a momentary pause in eating, an occasional start or gentle waggle of the ears.

Internal structure checked

The test animals are periodically slaughtered. University of Maryland zoologists Gordon Ramm and Robert Boord make extensive analytical tests to determine if any organic changes occur in pigs as a result of sound exposure. Ear structure comes under special scrutiny. In tests so far with 12 animals slaughtered after exposure to 120 decibels for 77 days, zoologists have found no difference in anatomical structure of the ear, thyroid, or adrenal glands.

Studies on the effects of sound are just one phase of the branch of science called animal behavior. This whole field is attracting increased interest among scientists. It's anticipated that important economic advances will be based on findings. ☆



Candling and EGG QUALITY

■ IN SELECTING EGGS, consumers are guided in part by grade—based primarily on candled quality. Tests by USDA and State experiment station researchers showed that candled quality of stored eggs was a fairly good guide to their appearance when broken out and to their cooking quality and palatability. But flavor scores for stored eggs were lower than for new eggs, even when candled quality was the same.

Newly laid eggs of A or AA quality were stored at room temperatures (68°–95° F.), in refrigerators (40°–45° F.), or in cold storage (30°–32° F.) to simulate common practice. Relative humidity ran 26 to 90 percent at room temperatures, 72 to 74 percent in refrigerators, 85 percent or more in cold storage. Storage ranged up to 10 months.

The eggs were candled as they were taken out of storage. Some were soft-cooked in the shell and tested for flavor. Others were broken out to measure raw-egg quality; then they were poached, or were baked in custards to determine thickening power or in angel food cakes to test leavening power. Each product made from stored eggs was compared with one made from newly laid eggs. Objective physical measurements were made and a trained tasting panel rated each product's palatability.

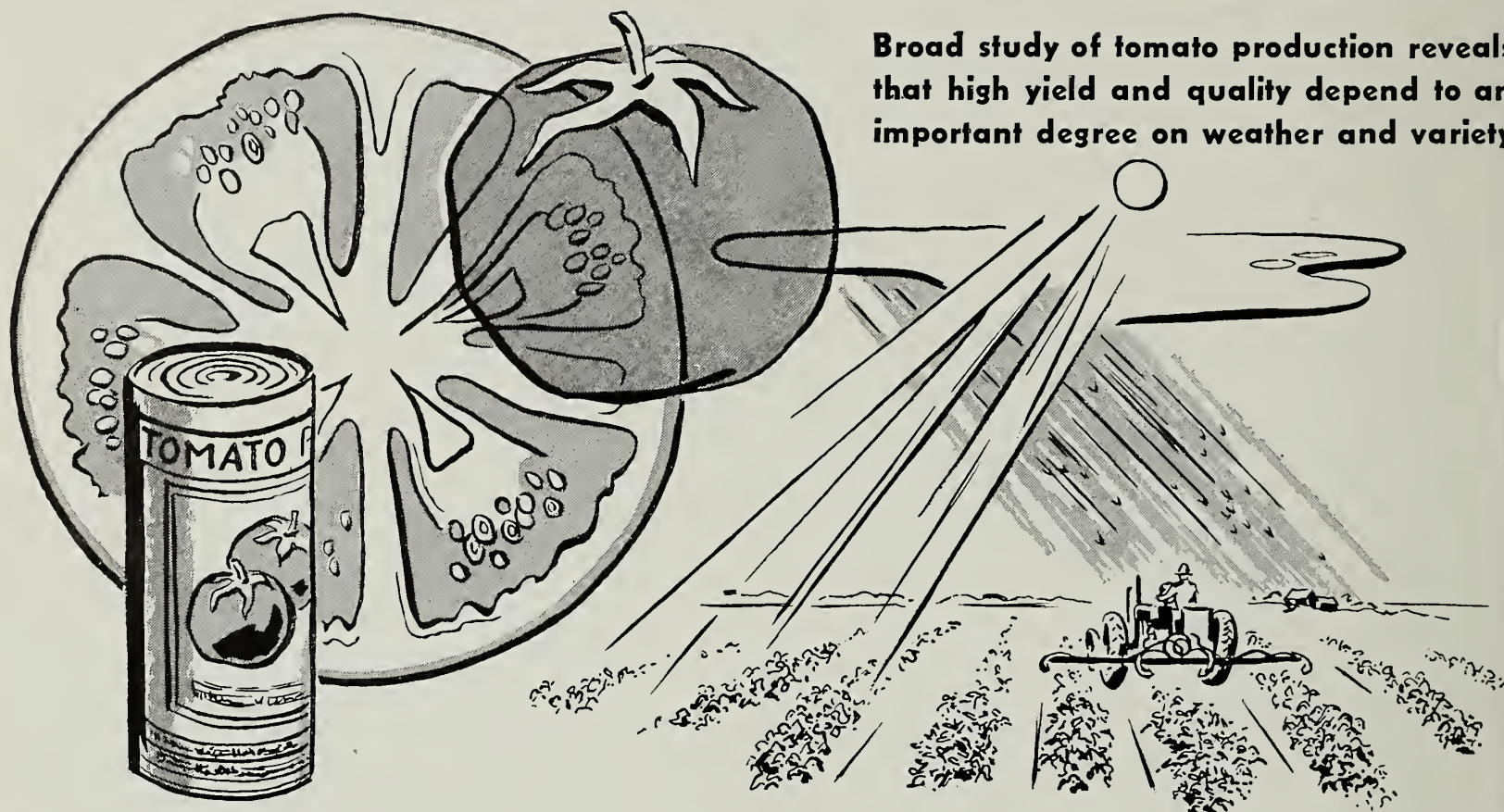
The studies are described by ARS food specialists Elsie H. Dawson, Cora Miller, and Ruth A. Redstrom in Agriculture Information Bulletin 164, "Cooking Quality and Flavor of Eggs as Related to Candled Quality, Storage Conditions, and Other Factors." Work was done under contract at three State experiment stations—by nutritionists Ruth Jordan at Indiana and Martha E. Hollinger at Louisiana, nutritionist Barbara A. McLaren and poultry scientist W. J. Stadelman at Washington.

Prompt, continuous refrigeration is essential if eggs are to retain top quality, tests showed. In raw albumen quality, for example, eggs held at room temperature were below average for A quality in 2 weeks; eggs in a refrigerator retained A quality for 18 weeks, those in cold storage for 40 weeks. On the other hand, eggs did not retain A quality flavor, as measured in soft-cooked eggs, more than 15 weeks in cold storage, 13 weeks in refrigerators, 1 week at room temperature.

Researchers point out that eggs in this study were placed in cold and refrigerator storage when newly laid and were stored in such a manner as to prevent absorption of off-flavor. If the eggs had been kept unrefrigerated for a time before storage, or stored with flavor-contaminating substances, flavor retention would have been less. ☆

BEHIND TOMATO YIELD AND QUALITY

Broad study of tomato production reveals that high yield and quality depend to an important degree on weather and variety



■ **TOMATO PROCESSORS** the country over may benefit from a recent USDA-sponsored study on effects of preharvest factors on tomato production.

Harvest weather conditions and tomato variety, more than any other factors, affect yield and quality of tomatoes, say researchers at the Maryland experiment station. Also studied for their effects on yield and quality were soil fertilization, foliar nutrient spray, and planting time.

Results of this 3-year study are especially beneficial to processors in areas such as the Middle Atlantic States where processed tomato production has declined slowly.

Tomato growers know that high temperatures limit tomato color. Production of lycopene, which causes the red color, stops at 85° F. Carotene development, which causes the yellow color, continues at high temperatures. In areas such as the Middle Atlantic States, where tomatoes

normally ripen during August's sizzling temperatures, tomatoes are not as well colored as they could be. This fact is especially important when you consider that bright red color and firmness are the two biggest quality considerations in buying tomatoes, for processors and housewives alike.

Shift of harvest attempted

To remedy this problem, researchers tried to shift the harvest peak of tomato production by delaying planting dates, so ripening would not occur during the hottest part of summer. Tests showed that the harvest peak was not affected by delayed planting—it resulted only in decreased yields. The harvest season of the delayed plantings started later and ended sooner than for earlier plantings. A possible reason for this shorter growing season is that the later plants flowered and set fruits at a less vigorous vegetative stage and

were always lagging in vigor as compared with the earlier plants.

Two popular varieties, Chesapeake and Rutgers, were planted at 2-week intervals for 3 plantings. The marketable yield of Chesapeake was sharply reduced as planting was delayed, with a difference of 4.1 tons per acre between the first and second dates (May 7 and 17) and 4.6 tons per acre between the second and third dates (May 17 and June 1). This steep descent was not observed in Rutgers variety, which declined 2.3 tons at the third planting date only.

The delay in planting increased the acidity of raw tomatoes of both varieties and decreased the soluble solids content in the canned juices.

Tomatoes examined from 6 successive pickings in the 3 plantings were different in nearly every aspect of quality. In most cases, differences were erratic and formed no specific pattern. Researchers believe that cli-

matic conditions preceding each harvest were largely responsible.

On the other hand, soluble solids, total solids, and pH followed a definite pattern, each continuously decreasing during the season. Since soluble solids are more or less direct photosynthetic products, their descending behavior may be due to exhaustion of the photosynthetic reserves in the plant during successive harvests. The decrease in pH suggests a general inverse relationship between sugar content and total acidity. The breakdown in carbohydrates during ripening toward the end of the season may result in higher organic-acid content in the fruit. Tomatoes are sweeter at the beginning of the season.

Ideal soil fertility and cultural practices were maintained in the tests. Horticulturists believe the trend to decreased solids would be exaggerated if such recommended practices were neglected. Low percentage of tomato solids in late summer is a common complaint among processors in the Middle Atlantic area.

Pulp forecasts juice color

A strong relationship was found to exist between the color of the raw tomato pulp and the color of the canned juice. This relationship may have forecasting value in selecting tomatoes for highest-quality juice.

Positive correlation also exists—although not strong enough to serve as a forecasting guide—between the color of raw tomato pulp and the color of processed tomatoes. Color retention is better in canned juice than in the canned whole tomato fruit.

Varieties and lines tested

In testing for the effects of tomato variety on yield and quality, researchers studied 13 commercial varieties and 7 STEP (Southern Tomato Exchange Program) lines. Rutgers, leading eastern-grown tomato, was out-yielded only by STEP 197.

Raw Rutgers was highest in color score, pH, soluble solids, and total solids. Valiant and three STEP lines were the only varieties giving less waste during pulping than Rutgers, although they required more trimming in preparation for canning. No differences were noticed in firmness of raw fruits in any variety. Canned tomatoes of all varieties were equally whole, firm, flavorful.

Rutgers canned juice was better in color and lower in acidity than the juice of other varieties. Manalucie was the only variety with higher soluble solids—but inferior flavor—as compared with Rutgers. Rutgers canned tomatoes were excellent in color, although drained weight was quite low. Tests of nine advanced

lines of the Maryland station revealed tomatoes with qualities equal to those of Rutgers in some respects.

Quality of processed tomato products does not seem to be related to above-normal fertility factors. Application of nitrogen, phosphorus, potassium, and magnesium well above normal limits had no pronounced effects on either yield or quality. Nor did application of magnesium and boron foliar sprays. Chelated calcium sprays resulted in good retention of red color; more work is needed to explain this function of calcium.

Since it's not possible to shift the peak of harvest by varying planting dates within economical limits or to relate quality to above normal fertility factors, other preharvest quality-control measures need to be studied. Irrigation is a partial control, and experiments are showing its value.

Breeding holds big promise

Biggest quality-control measure, however, lies in the development of superior, high-yielding, disease-resistant tomato varieties that have good flavor and good color. Color and firmness improvement—major consideration in the Middle Atlantic area—is primarily a breeding problem. ARS tomato specialists are making progress in adapting new selections for processing.☆

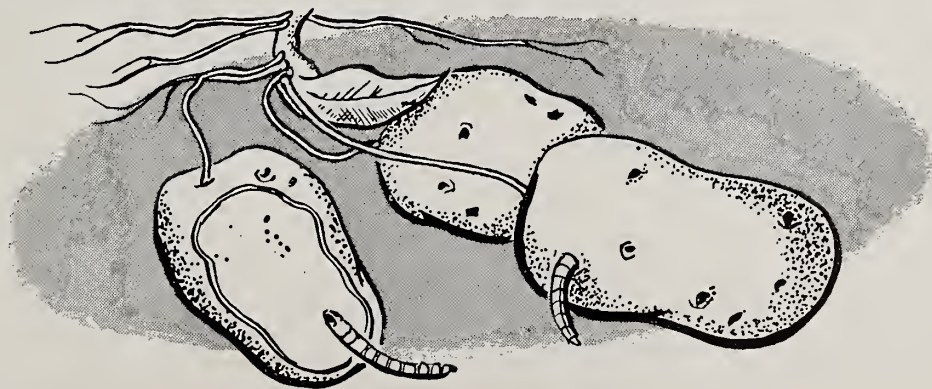
Some Advances Against Insects

■ USDA AND STATE scientists are always searching for ways to eliminate waste caused by insects. Entomologists working on truck crop and garden insects look for means of over-

coming resistance to insecticides, safer ways to handle chemicals, and more effective materials.

The southern potato wireworm (*Conoderis falli* Lane), which attacks

Irish potatoes, recently developed high resistance to chlordane in Charleston County, S. C., after several annual soil applications. Usually, insects such as wireworms, which have



relatively long life cycles, have not developed resistance rapidly.

Chlordane mixed with the soil gave satisfactory control of the southern potato wireworm at the South Carolina experiment station from 1952 to 1954. In 1955 and 1956, control diminished, indicating resistance. Now, scientists are searching for other materials to give satisfactory control and are trying to learn something about the mysteries of resistance.

Finding chemicals safer to handle is still another goal. Experiments at the South Carolina station show Bayer L 13/59 is less hazardous and as effective as parathion drench to control green June beetle larvae on tobacco plant beds. Scientists get best results by mixing 8 ounces of 50-percent L 13/59 wettable powder with 50 gallons of water. This is applied with a sprinkling can, 100 gallons per 100 square yards.

Researchers are looking for more effective materials to control three insects that attack turnips—seed-corn maggot (*Hylemyia cilicrura*), sugar beet wireworm (*Limonius californicus*), and white grubs. Reports from the ARS Whittier (Calif.) entomology field station show that dieldrin applied to the soil at 2.3 to 3.3 pounds per acre before planting gave better control than other materials tested against these three insects.☆



Enriched Hay Mulch—Apple Reviver

■ **NITROGEN-ENRICHED** hay mulch did something fertilizers failed to do for weakling apple trees on soils in poor physical condition as well as on soils low in magnesium. Mulch made the trees thrifty and productive.

On poorly drained soil at USDA's Agricultural Research Center, Beltsville, Md., mulch worked well for trees that had had "wet feet" for 15 years. Although fertilized chemically since planting, those trees were weak rooted and underdeveloped until mulched.

Poorly drained soil aided

C. P. Harley and associates brought in hay for the nonvigorous trees annually for 9 years from a field of orchardgrass and tall fescue. When grown without fertilizer, this grass tested only 1.09 percent nitrogen—low compared to the 2 percent or more for most legume hays. Part of the grass, however, was grown with 100 pounds per acre of actual nitrogen added. It has 2.38 percent nitrogen at the blossom and aftermath cutting stages. Annual applications of one-half pound of enriched air-dried grass

hay per square foot of ground surface restored vigor to the trees.

Harley says the high-nitrogen mulch helped in several ways. It enlarged the root system by a fourth, mostly at the soil surface. And it gave those roots direct access to a rich, balanced nutrient supply including micro or trace elements.

Enriched hay mulch caused noticeable growth and better foliage color the first year, marked improvement the second year, and outstanding productivity and vigor thereafter. This vigor has continued during the 9 years the trees have been treated.

On magnesium-deficient soil at Beltsville, 3-year-old trees were unthrifty and showing leaf blast (a sign of magnesium deficiency) when the second hay-mulching experiment was started. Both soil magnesium and applied magnesium were tied up by the soil and withheld from the trees. Excess applied magnesium sometimes ties up other soil nutrients, too.

Ordinary grass mulch alone didn't overcome magnesium hunger. But when the hay was grown with mag-

nesium fertilizer or the mulch topped with magnesium sulfate, tree roots picked up magnesium directly from the decaying organic matter. The magnesium didn't necessarily all reach the soil, although Harley thinks mulch might overcome some of the soil's fixing power for magnesium and permit normal root feeding.

Magnesium hunger relieved

The magnesium-mulch treatment removed practically all symptoms of magnesium hunger in the trees in 3 years. When the mulch was also enriched with nitrogen, recovery was faster and the trees more vigorous.

A permanent cover crop maintains the humus supply, which gives soil a granular crumb structure. That improves drainage, aeration, water absorption, mineral storage. Many orchardists think permanent sod is the total answer to trees' nutritional needs. But humus created this way seldom adds substantially to the total, says Harley. High-nitrogen mulch brings in rich supplies of organic matter and nutrients from another field.☆

A New (and Bad) Weed

Witchweed has staked its parasitic claim in the eastern part of the country, threatening to ruin corn and other grassy crops by destroying their roots. Discovery of the weed (*Striga lutea* or *Striga asiatica*) at more than 40 locations in North and South Carolina is its first reported occurrence anywhere in the Western Hemisphere, USDA weed researchers believe.

This harmless looking weed damages below ground, penetrating roots of host plants on which it lives and depriving them of nutrients and water. Witchweed may also inject into host plants a substance that interferes with natural plant growth.

If witchweed became widespread it might destroy more of our corn than the corn borer, which costs farmers some \$80 million a year. In other countries, witchweed is known to attack summer-grown small grains, sorghum, sugarcane, rice, pasture grasses. It is already a scourge of corn and sorghum in South Africa and a serious pest of rice, sugarcane, and other crops in the Far East.

Many practical approaches such as chemical and mechanical weed killers, soil fumigants, and planting of "trap crops" are being explored as controls. Trap crops—they include such plants as peanuts, soybeans, and cowpeas—cause dormant seeds of witchweed germinate, but the pest is unable to parasitize such crops.

They Made Real Rubber

Laboratory synthesis of natural rubber has been achieved for the first time through cooperative research by USDA and State scientists.

This test-tube rubber is not the same as ordinary synthetic rubber made

from coal or petroleum. Researchers started with enzymes from the rubber plant and, by adding a vinegar-like acid, compounded real rubber. Plant physiologists H. J. Teas, ARS, and R. S. Bandurski, Michigan State University, are credited with demonstrating rubber synthesis.

These scientists separated cell-free plant enzymes capable of forming compounds known as isoprenoids, which include rubber. This opens the way for synthesizing certain compounds that are chemically similar to rubber and may be of economic importance. The makeup of rubber relates it to vitamin A and to many essential oils used in perfumes and flavorings. Knowledge gained in these experiments might also be used in breeding improved rubber trees, for studies shed much light on how they grow and produce latex.

Results of this research constitute an important contribution to fundamental knowledge about the synthesis of large molecules in plants.

Before Moving Cattle

Interstate movement of all cattle except steers, spayed heifers, and calves under 8 months old came under USDA control January 1, 1957, to curb the spread of brucellosis. This should strengthen the all-out brucellosis-eradication program operated jointly by USDA and the States (AGR. RES., December 1954, p. 14).

Most cattle other than the above exceptions cannot move interstate without either an official certificate, or a permit from a livestock sanitary official of the State of destination, or both. Those requirements are specific to cover each situation. Violation of any part of this regulation is punishable under Federal law.

A previous regulation still applies to *reactors to the brucellosis test*. Eartagged and branded, they may move under official certificate to slaughter at a plant under Federal inspection or one specifically approved by USDA or to an approved public stockyard for sale to such a slaughtering plant. Under the new regulation, *cattle not known to have brucellosis* also can be shipped to



such plants for immediate slaughter or to a public stockyard or one approved by USDA. They require a way-bill or similar document or certificate signed by the owner or shipper, describing animals shipped.

Two classes of cattle can move into any State with comparative ease. *Cattle from brucellosis-free herds and areas* need only an official certificate. And *officially vaccinated animals under 30 months old* can move with only an official certificate, except those moved into a modified-certified brucellosis-free area. These must have, in addition, a permit from the livestock sanitary official of the State of destination authorizing entry.

Officially vaccinated over 30 months old can be shipped to non-certified areas under an official certificate and a permit from the State of destination if within the preceding 30 days they have been blood tested and reacted no higher than incomplete agglutination at the 1:100 dilution. If they move into a modified-certified brucellosis-free area, however, they must then be quarantined until tested negative or slaughtered.

Most *nonvaccinated over 8 months old* can move under official certificate

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if tested negative within 30 days of shipment, provided that those going into a modified-certified brucellosis-free area also have a permit from the State of destination and are then quarantined until tested negative after 30 days or slaughtered. There's an exception, however, for animals from a Federal-State supervised herd that has tested reactor-free within 90 days before shipment. They can be shipped anywhere under official certificate only, if each one shipped has tested brucellosis-free at least 30 days after the herd test but within 30 days of shipment of the animals.

Beef bulls and females shipped for feeding or grazing only can move under official certificate and permit from the State of destination, if that State legally requires segregating and quarantining such cattle.

This is, of course, an oversimplified version of the regulation. Interested persons should get further details or copies of the regulation from State and Federal livestock sanitary officials in their area or from Animal Disease Eradication Branch, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C. Shippers should consult livestock sanitary officials in the State of destination as to the effect of that State's regulations on cattle when received.

Machines Can Sell Milk

Vending machines—which increased sales of soft drinks, cigarettes, and candy—now show promise of

enlarging demand for dairy products. Dairymen are beginning to use these machines successfully, according to a recent USDA survey conducted by agricultural economist Hughes Spurlock of Farmer Cooperative Service. The industry is taking advantage of impulse buying—thirsty consumers often buy fresh milk at an opportune time, even in competition with other drinks, the survey shows.

Some 22,000 vending machines are providing half-pint and third-quart cartons of chocolate milk, buttermilk, and milk—totaling a \$39 million



business last year. Many of the machines are operated by co-ops.

Of the schools, military installations, filling stations, transportation terminals, hospitals, and office buildings surveyed, three-fourths plan to install more machines. Present sales represent about one-tenth the volume of bottled soft drinks and a small fraction of the total \$1.7 billion vending-machine business.

The survey indicates that fully automatic machines show a profit if they have a turnover of more than 60 half-pint cartons or 65 third-quart cartons daily, selling for a dime. Operators who use semiautomatic machines earn a profit with sales over 39 half-pint or 43 third-quart cartons. Largest profit came from automatic machines containing third-quarts—

although the profit per carton was less, more sales were made.

Careful With That Silo

Silo-filling can be deadly, USDA warns farmers and their family.

Nitrogen dioxide, a poisonous gas that may form in fresh silage, can cause "silo-filler's disease," hazardous to human beings and livestock. As little as 100 parts per million of the gas in the air can be dangerous. Farmers should be on guard before another silo-filling season begins.

Silo-filler's disease causes severe coughing and burning or choking pains in the throat and chest. A person who has these symptoms while working in the silo, or afterward, should see a doctor immediately. Serious illness or death can result from delay. Farmers should take extra precautions when filling silos with corn grown in hot, dry years or with silage made from corn that received heavy applications of nitrogen.

USDA scientists recommend the following precautions: (1) Run the blower for 10 minutes before going into a partly-filled silo and keep it running while inside; (2) be alert to irritating odors—the gas tends to settle in the silo chute and base; (3) look for yellowish-brown fumes—use a flashlight if the silo is dark; (4) keep children and animals away from a silo during filling; and (5) wait at least a week before going inside a filled silo and don't let children or animals stay near it.